

# Ozone and PM2.5 in Atlanta, GA

Roy C. Lander, Mill Springs Academy, Alpharetta, GA  
NASA Mentor: M. Pippin, NASA LaRC



Mill Springs Academy

## Background

### INTRODUCTION

The greater Atlanta area is a good area to research ozone and PM2.5 levels because it is a major metropolitan area that not only is landlocked but also has dense forests. Economically, the city is known for its diverse commerce and for being a transportation hub. Consequently, Atlanta has air quality issues that impact its inhabitants and their health (see Figure 2).

To delve into ozone and PM2.5, both satellite data and ground station data were captured and analyzed. To capture ground station data, prevailing weather patterns were considered. Consequently, three separate ground stations were chosen (see Figure 1): Yorkville, Confederate Ave., and Gwinnett. Yorkville is located northwest of the metropolitan Atlanta area and is the most rural location of the three ground station locations. Because of its rural location, it has the highest forestation along with the least man-made ozone. The second location, Confederate Avenue is nearest downtown Atlanta, and, as a result, should see higher pollutant levels than Yorkville. Weather patterns would tend to blow pollutants from the suburbs into downtown and Confederate Avenue in an westerly, southwesterly or northwesterly direction. The final station, Gwinnett is northeast of Atlanta in an area that is quite developed and that experiences heavy car and truck traffic. It also happens to be within a few miles of a suburban airport, Briscoe Field. Typical weather patterns would move pollutants from the downtown area either directly into this area or south of this location.

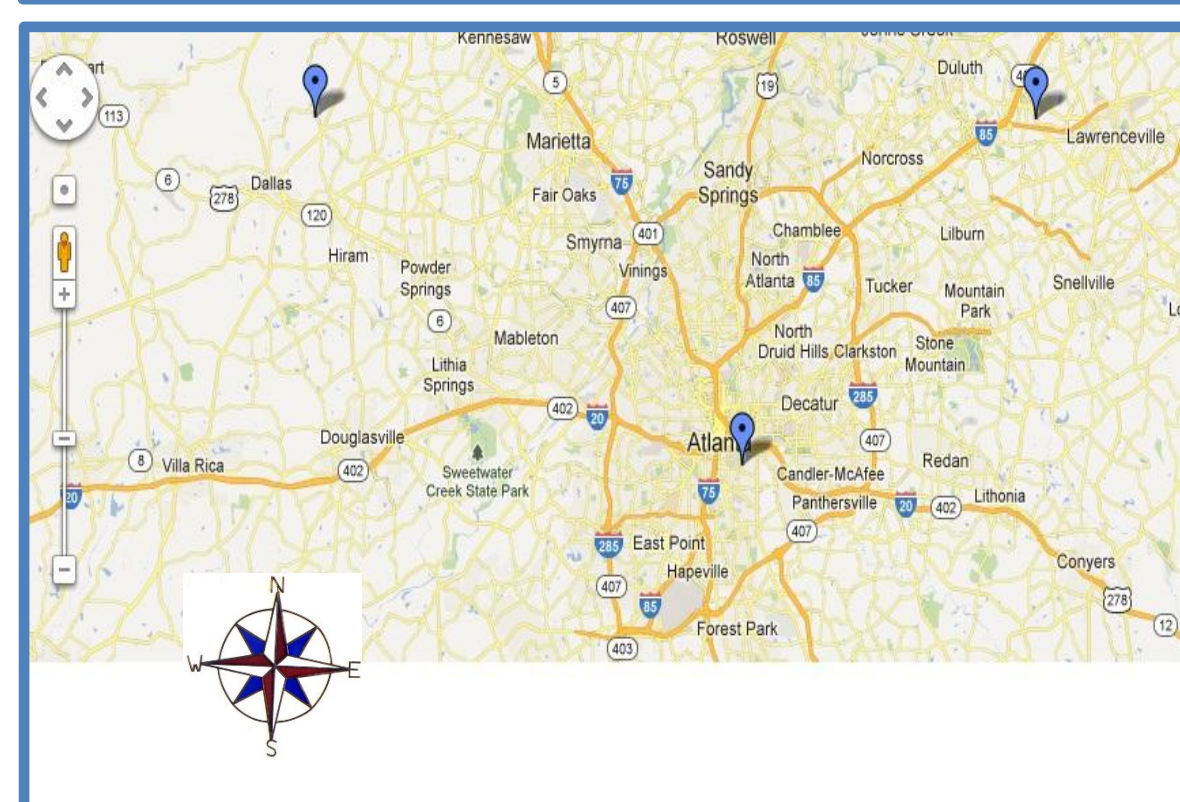


FIGURE 1: Atlanta Ground Station Locations  
(left to right –Yorkville, Confederate Ave, and Gwinnett)

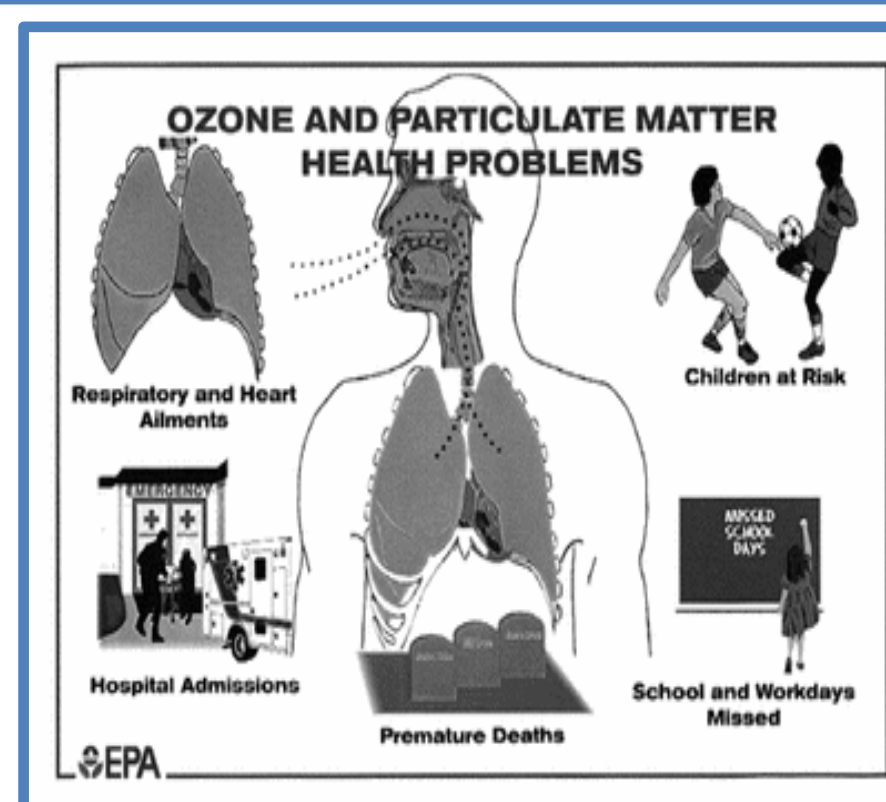


FIGURE 2

Air Quality Index for Ozone (based on 8-hr average concentrations)		
Index Values (Conc. Range)	Air Quality Descriptors	Cautionary Statements for Ozone
0 – 50 (0-59 ppb)	Good	No health impacts are expected when air quality is in this range.
51 – 100 (60-75 ppb)	Moderate	Unusually sensitive people should consider limiting prolonged outdoor exertion
101 – 150 (76-95 ppb)	Unhealthy for Sensitive Groups	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion
151 – 200 (96-115 ppb)	Unhealthy	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children should limit prolonged outdoor exertion
201 – 300 (116-374 ppb)	Very Unhealthy	Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.

FIGURE 3

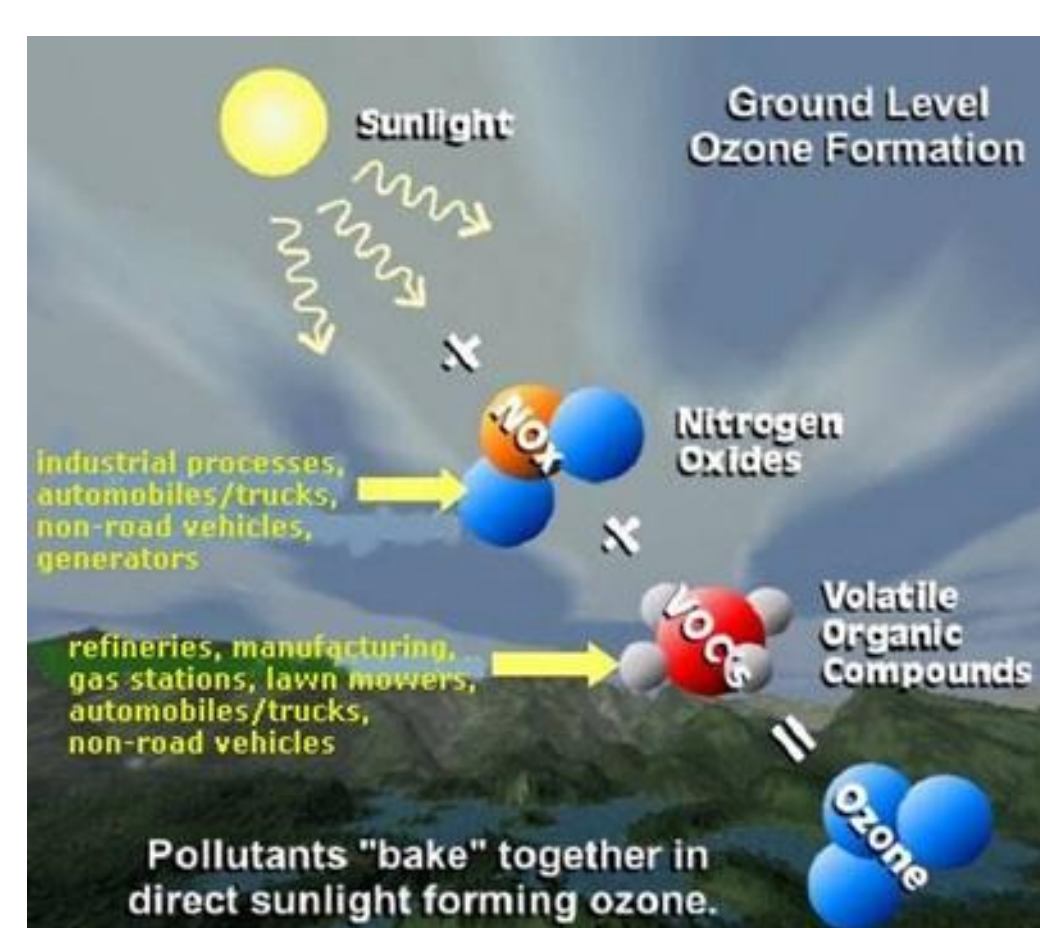
### ACKNOWLEDGEMENTS

This work was supported by the Long-Term Engagement in Authentic Research with NASA (LEARN) project with funding provided through a NASA SMD EPOESS grant. I would like to thank the NASA LEARN program and NASA for access to the information used to complete this research.

### REFERENCES

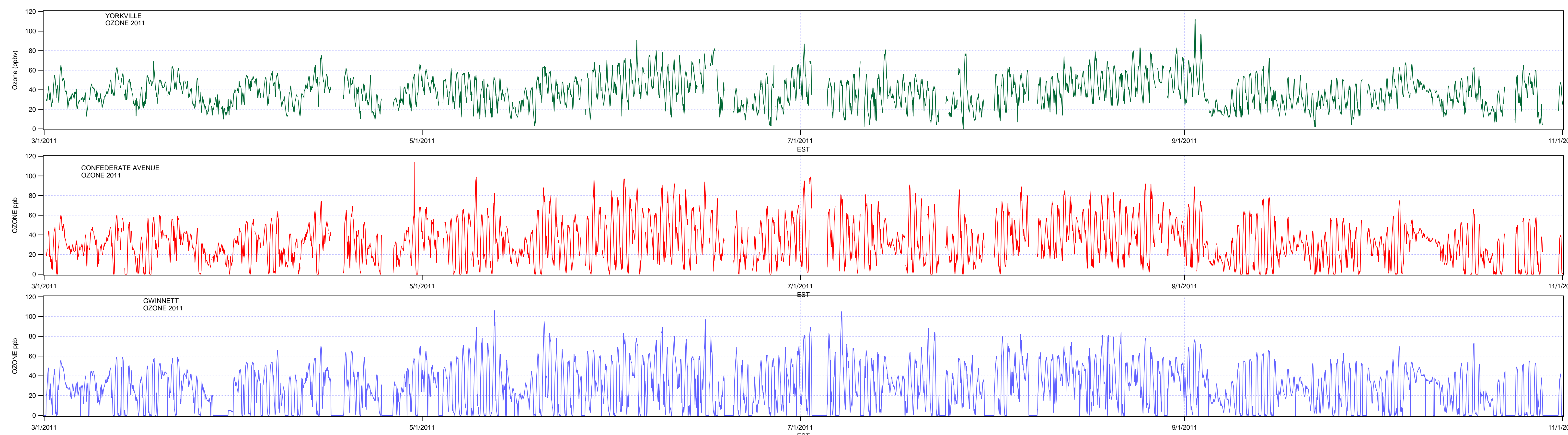
- [www.airdata.epa.gov](http://www.airdata.epa.gov)
- [www.epa.gov/pm/](http://www.epa.gov/pm/)
- [www.georgiaair.org](http://www.georgiaair.org)
- [www.star.nesdis.noaa.gov/smcd/spb/aq/](http://www.star.nesdis.noaa.gov/smcd/spb/aq/)
- [www.epa.gov/airdata](http://www.epa.gov/airdata)
- [www.mynasadata.larc.nasa.gov](http://www.mynasadata.larc.nasa.gov)
- [www.cleanairstandards.org](http://www.cleanairstandards.org)
- [www.who.edu](http://www.who.edu)
- [www.aura.gsfc.nasa.gov](http://www.aura.gsfc.nasa.gov)

FIGURE 4

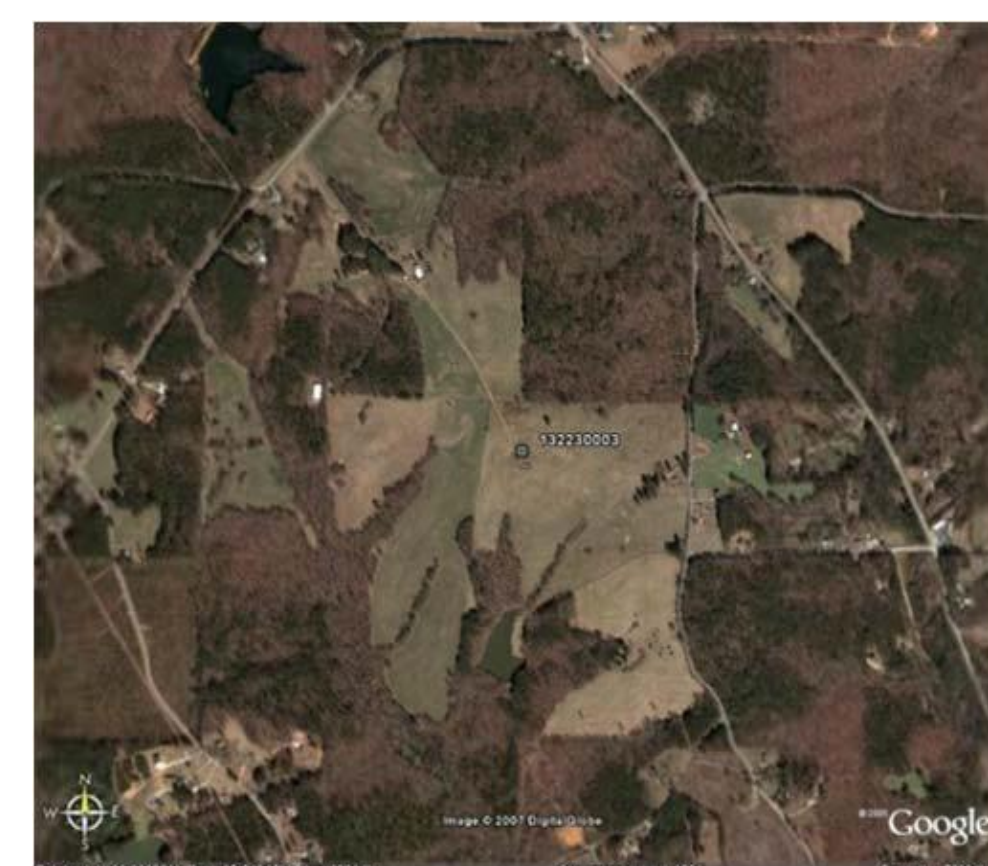


## Time Series

FIGURE 5



The ozone time series graphs (Figure 5) for 2011 show that the most rural location, Yorkville, experiences the least ozone titration (Figure 4) while Gwinnett and Confederate Avenue exhibit the most titration. Yorkville also exhibits the least range in ozone values throughout the year as this ground station experiences the smallest amount of fossil fuel burning by either industry or transportation. Throughout 2011, the sites exhibit ozone values that fall primarily in the good or moderate AQI zone (Figure 3). The PM2.5 time series graphs (Figure 6) for 2011 show relatively small ranges in values during the early and later part of the calendar year. Each station, however, exhibits some unique readings at times. During September (see orange oval), the three stations exhibit significant differences in readings during the September 13 through September 15 time frame. See the case study and the accompanying graphs in figure 8 for more detail.



YORKVILLE, GEORGIA SITE GA EPD Site #132230003



CONFEDERATE AVE., GEORGIA SITE GA EPD Site #131210055



GWINNETT, GEORGIA SITE GA EPD Site #131350002

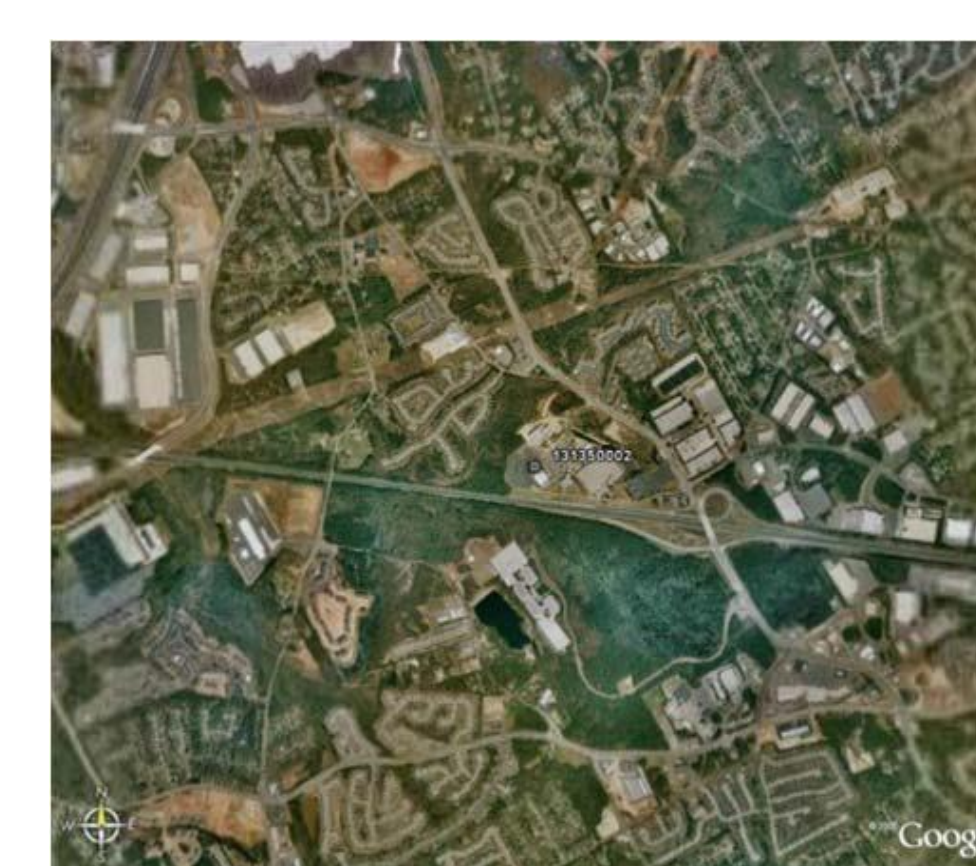
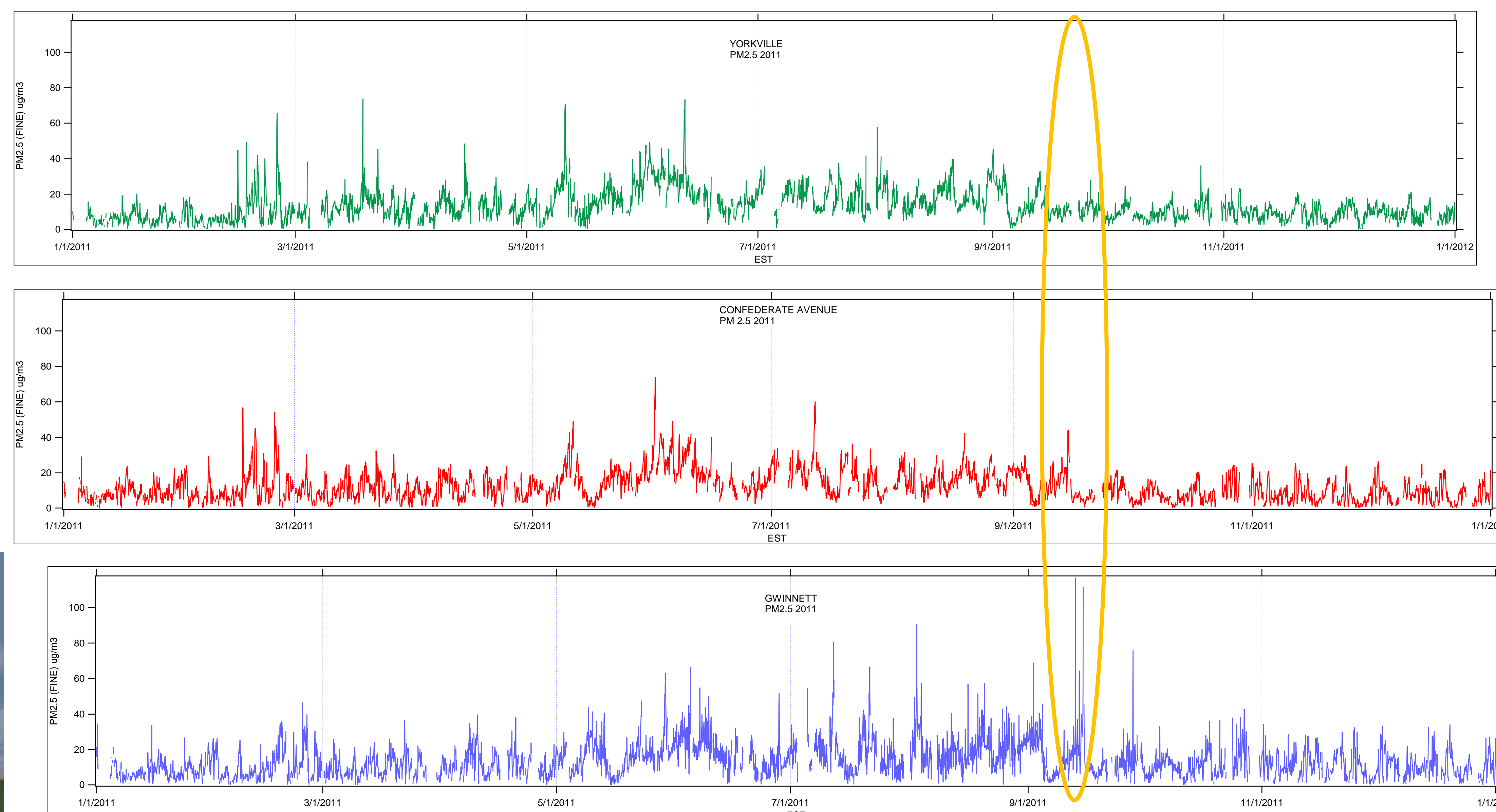


FIGURE 6



## CASE STUDY

FIGURE 7

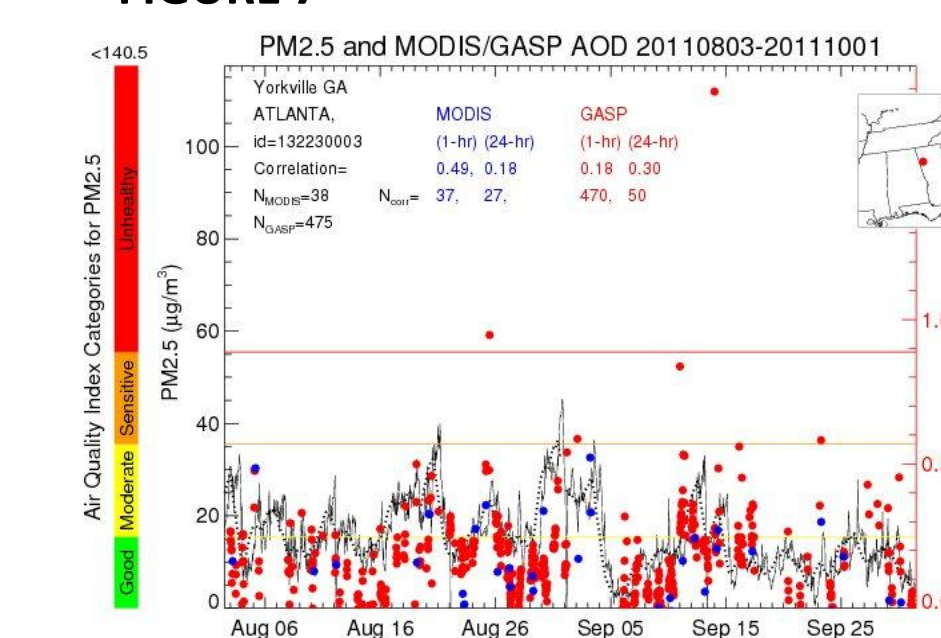
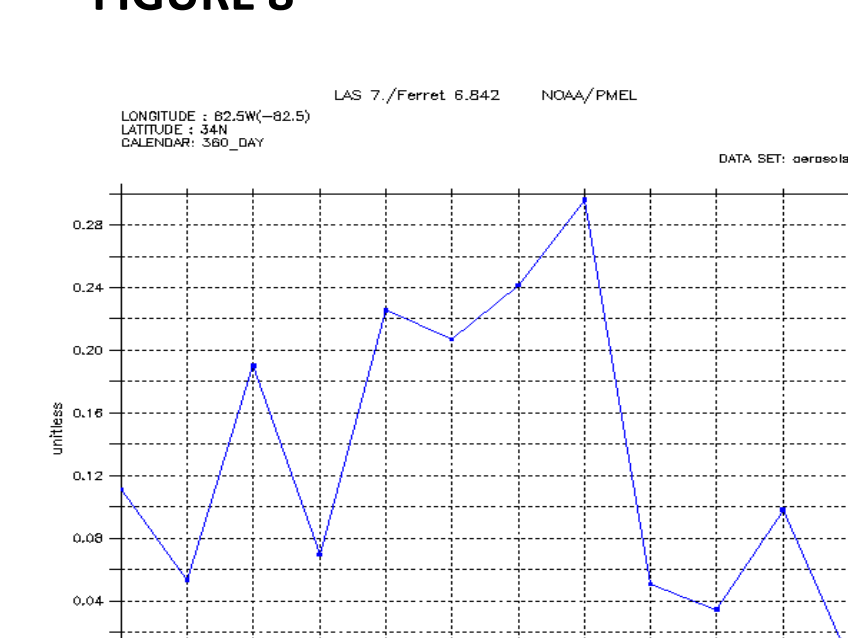


FIGURE 8



### NASA CALIPSO

The case study of PM2.5 looked for correlations between NASA satellite data and the three aforementioned ground stations. On September 13 and 15, 2011, unique PM2.5 values were observed in the ground station data (see orange oval in Figure 6) with Gwinnett having readings in excess of 100 ug/m<sup>3</sup> on these two days. Further examination confirmed that the data points were not anomalies. NASA satellite data from both MODIS and GASP (see Figure 7) were then reviewed to look for a correlation in the data. Both the Yorkville and Confederate Avenue graphs exhibit correlation between the satellite and ground station data. However, the Gwinnett site exhibits high ground station values that do not correlate to the satellite data!